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A C/C++ Simulator with Capabilities for Gradient Computations

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A C/C++ Simulator with Capabilities for Gradient Computations

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We develop numerical algorithms for optimal control of oil and gas recovery. The algorithms combine simulations of the subsurface reservoir flow with a numerical optimization algorithm. The optimization algorithm iteratively improves the production strategy until an optimal strategy is reached.

The optimization requires a number of simulations, each of which is computationally expensive. We therefore use efficient optimization algorithms combined with an adjoint method to compute gradients, which requires significantly fewer simulations compared to simpler gradient-free optimization algorithms.

We present a numerical example of optimal control of compositional and thermal reservoir flow. The example is based on a recently developed C/C++ code, and the implementation uses a cubic equation of state to evaluate thermodynamic properties of the fluid.

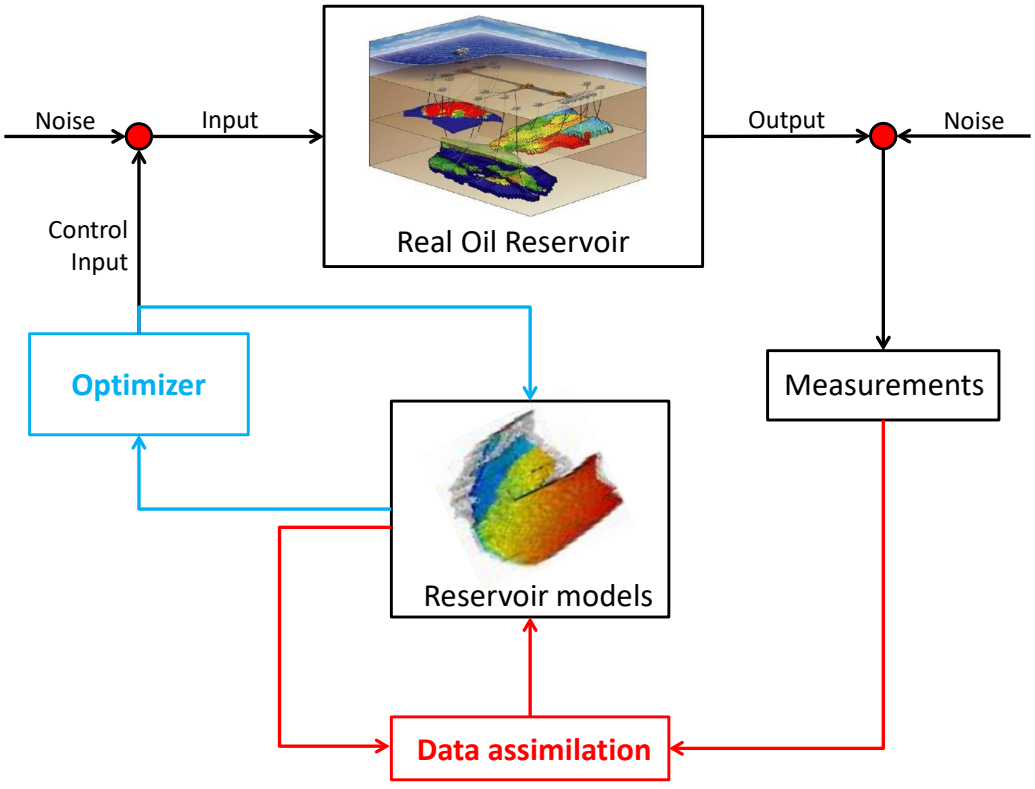

Fig. 1: Diagram illustrating the role of optimal control (the blue loop) in a production optimization workflow (known as closed-loop reservoir management).

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